

From observations which I have recently made it seems evident to me that the cause for seeing the motion is entirely different.

In the first place, you can always see the motion a fraction of a second before you begin to feel it. In the second place, you cannot see a perfectly horizontal motion or a gentle vertical (heaving) motion. In the third place, watching a fixed point close to you, such as a pattern on a carpet, when the ship is pitching and rolling, is far more tiring to the eyesight than when the ship is motionless or running perfectly steadily. All this points to the appearance being due to a true relative motion of the eyes to the ship.

The eyes are suspended in their muscular settings, much in the same way as are ships' compasses in their binnacles. The eyes are, furthermore, perfectly balanced, so as to make their muscular displacements as little tiring as possible. In their normal position, the pull of gravity is exerted vertically through their centres, and the muscular mechanism is compensated for gravity.

Any angular change of position will displace the eyes just as it displaces the stomach, excepting that the eyes, being a great deal more sensitively suspended, will register the displacements more quickly. It is not, however, the motion of the eyes which strains the eyesight, but the act of resisting this motion.

If, with your eyes shut, you attempt to fix the mental representation of a point, which a moment previously you were watching with eyes wide open, you will find that, after one or two motions of the ship, the bodily feeling will precede any visual sensation which your imagination can conjure up. The imaginary point is no longer fixed, but follows the eyes as they let themselves go to the motions of the ship. No strain of the eyesight is caused by a muscular resistance, and the displacements, while felt, can no longer be seen.

ALFRED SANG.

Pittsburg, U.S.A., February 26.

Production of an Electrically Conductive Glass.

EXPERIMENTS have from time to time been made, both in England and abroad, to ascertain what ingredients are best for the purpose of producing glasses of very high electrical resistance.

The utility of a vitreous substance which would conduct electricity comparatively well does not appear, however, to have so far claimed any consideration.

I beg therefore to direct attention to a glass which has recently been made in my laboratory. Its chief feature is that it readily conducts electricity.

For the windows or cases of electroscopes and all high-tension apparatus requiring a transparent cover capable of screening off external electrical fields, this material offers many advantages. A conducting varnish is no longer required for glass which conducts electricity itself. In addition to these practical considerations, there arises the interesting question as to the process by which electricity passes through this substance—whether it is electrolytic. Its resistance varies very markedly with temperature changes. I hope later to give more precise details. The basis of the glass is sodium silicate.

CHARLES E. S. PHILLIPS.

Shooters Hill, Kent, March 12.

Interpretation of Meteorological Records.

IN discussing the records of the meteorological instruments at Canterbury (*NATURE*, March 15), Dr. Aitken suggests that the heavy rain which fell dragged down the higher air, and so caused the fall of 12° indicated on the thermograph curve, and he very clearly and convincingly shows the consequent effect on the barometric pressure and wind velocity. If, however, the air had been in a state of stable equilibrium previous to the thunderstorm, the effect of such a mechanical dragging down of the higher air would have been to heat by compression that air so much that the temperature would have been raised rather than lowered at the ground-level. But if, previous to the storm, the upper air had from any cause become very much colder than the lower air, the atmosphere would be in a state of unstable equilibrium, that is to say, the rate of

change of temperature with height would be greater than the adiabatic rate of change due to heating by compression of descending air. In such a case the changes recorded by the various curves may have been initiated by this heavy cold air suddenly descending and displacing the lower air, which by its sudden uprising would be cooled, the moisture in it condensed, and a heavy fall of rain caused.

The lightning which accompanied this storm introduces an element of uncertainty into any attempted explanation, for we do not know yet the manner in which electric charges are generated in the atmosphere. But it seems probable that a great cooling of the higher air is an accompaniment of a state of electric tension, for it is difficult to see otherwise why a thunderstorm should be followed by a lowering of the temperature near the ground-level.

R. T. OMOND.

Edinburgh.

Oscillation of Flame Cones.

I SHOULD be glad if any of your readers could give an explanation of the cause of the following flame phenomenon, produced while experimenting with a modification of Prof. Smithells's apparatus for the separation of the cones of a Bunsen flame.

A mixture of gas and air is burned at the top of a vertical tube (made preferably of combustion tubing) about 4 feet long and $\frac{3}{8}$ inch to 1 inch in diameter, having a delicate screw adjustment for regulating the proportions of gas and air.

The air supply is carefully and slowly increased, until an almost explosive mixture is reached, and the inner cone is very short and sharp and of a light green colour. On admitting a very slight increase of air after this point, the inner cone (sometimes the two cones) descends the tube to a distance of about 2 feet, and then pauses and goes up again, re-joining the outer cone. The flame then "sharpens" again and repeats the process, and will continue to do so for several hours without further adjustment of the gas or air being made.

There is every appearance of an explosion wave being propagated, as shown by the increasing velocity of the descending flame and by the occasional emission of a note as it reaches the end of the travel.

The length of travel can be regulated by the amount of air admitted, varying from 1 or 2 inches to about 2 feet in the same tube. If it be allowed to exceed a certain limit the inner cone is extinguished at its lowest point, but immediately re-lights at the top of the tube, and then returns as before. The periodicity can be varied from about once in five seconds to once per second.

The gas pressure does not need any special regulation, the ordinary variations from a town supply not affecting the results.

The following are the points requiring explanation:—

- (1) As the proportions of gas and air are constant, what is the cause of the periodic "sharpening" of the cones after meeting at the top of the tube?
- (2) What prevents the explosion wave being completed, and the consequent firing back of the mixture?
- (3) What causes the inner cone to return and travel up the tube, re-joining the outer one at the top?
- (4) The alteration in the character of the flame (in view of the fact that the proportions and pressure of gas and air are constant) points to some form of wave motion bringing the molecules into closer contact. If this be so, what are the conditions which set up this wave motion and what determines its periodicity?

HAROLD E. TEMPLE.

Olton, Warwickshire.

THE phenomenon described in the foregoing letter is in part dealt with in a paper by Dr. Ingle and myself in the *Transactions of the Chemical Society* for 1892 (vol. lxi., p. 204). The continued oscillation of the inner cone is, I think, explained by the fact that the mixture of gas and air in the tube is not uniform. We have, indeed, found it necessary to use elaborate mixing appliances to make it uniform. When a portion of the mixture rich in air reaches

the top of the tube the inner cone is propagated through it and descends until it reaches a stratum richer in gas, when it re-ascends. The fluctuation in the composition of the gaseous mixture escaping from a Bunsen burner can be seen by the throbbing of the inner cone, when the air supply is considerable. I may add that in the construction of burners for the incandescent mantle great importance is attached to the perfect mixing of gas and air, since it becomes possible thereby to have a steady flame with a relatively large quantity of primary air.

The University, Leeds.

A. SMITHELLS.

Gas for Heating and Lighting Laboratories.

I SHALL be greatly favoured if you will inform me which are the best "gas-making plants" for supplying a laboratory with gas derived either from coal, or paraffin oils.

Do you know anyone who has had experience of these? I more particularly incline to those easily managed and maintained, simple and inexpensive.

ALEX. PARDY.

Lynne House, Albyn Lane, Aberdeen, March 7.

If I were fitting up a large laboratory I should put in a small water gas generator and inject paraffin oil into the fuel during the period of steaming, fixing the hydrocarbons in the gas produced by passing through a superheater.

I see in the Journal of the Society of Chemical Industry for February 28 a paper by Masumi Chikashige, who had been fitting up the Kyoto University laboratory with a gas made in this way, and of which he gives the results, which appear to be very satisfactory. In the discussion upon the paper your correspondent will also find some useful hints as to the fitting up of laboratories with heating-gas where coal-gas is not available.

If he should not require enough gas to make a small carburetted water gas plant successful, and if he can get petrol or benzene, he will probably find carburetted air the cheapest thing to use.

VIVIAN B. LEWES.

Royal Naval College, Greenwich, S.E., March 12.

Cooperation between Scientific Libraries.

As this subject has recently been receiving attention in NATURE, it may interest some readers to know that the Royal Society of Edinburgh is taking steps for the purpose of finding out what can be done so far as the south of Scotland is concerned. A committee, of which I am convener, has been appointed by the council, and this committee is at present engaged in obtaining information from the various libraries of Edinburgh and Glasgow. It is hoped that later on a conference will be held, at which suggestions for joint action would be considered, and an endeavour made to draw up a scheme of cooperation for consideration by the various societies and institutions directly concerned.

I shall be very glad to supply information regarding the work of the committee to anyone who is specially interested in it, and also to receive particulars of any similar work which is being undertaken elsewhere.

HUGH MARSHALL.

University of Edinburgh, March 26.

THE PROBLEMS OF GEOLOGY.¹

THIS admirably printed book deserves description rather than criticism, since the author, in his wide range of personal observation and reading, aptly plays the critic to the views that he successively propounds. With an unnecessary assumption of modesty, he apologises in his preface for "the clumsiness of a geologist, who is more at home with the hammer than the pen." We can scarcely believe that one who has tinged even his most serious scientific contributions with the high attraction of literary style

¹ "The Age of the Earth, and other Geological Studies." By W. J. Sollas, D.Sc., F.R.S. Pp. xvi. + 328. (London: T. Fisher Unwin, 1905.) Price 10s. 6d. net.

can in reality know so little of himself. Almost all the papers in the present volume state a proposition and sustain an argument. There is, perhaps, a lighter one, describing a visit to the Lipari Isles; but even this contains a theoretical explanation of a difficult problem at the end. Yet the book is entirely readable, and will serve to bring to workers in all manner of fields the views of one who holds that nothing terrestrial is foreign to the subject of geology.

The papers are of various modern dates, and might, as we venture to think, have been brought nearer to uniformity in the text itself. Corrections are introduced in footnotes; but essays need not be treated as prize-poems, to be crowned with honour, and to remain unalterable. We do not want to read, for instance, that "the boring party is at this moment at work" on Funafuti, when evidence is immediately given that the task was completed seven years back. But this is a matter of pure detail; the scientific considerations put forward are uniformly fresh, vigorous, and inspiring.

The article on "The Age of the Earth" naturally brings us to no definite conclusion, seeing that the data on which a correct judgment depends are still of the scantiest description. A large number of readers, however, rejoice in such discussions; and we even discern grounds for combat when we are asked to believe that the opening of the fossiliferous stratified series lies only twenty-six million years behind us. In the following paper, on "The Figure of the Earth," we are introduced, as general readers, to Mr. Jeans's very recent hypothesis of a pear-shaped primitive earth, and a secondary pear-shaped earth with an equatorial bulge. Lest we should pin our faith to these or any other proposed forms, we shall do well to notice the excellently chosen language in which the author places them before us. In the discussion of the earth's loss of heat, radium is held up to us (p. 63) as "threatening to destroy all faith in hitherto ascertained results, and to shatter the fabric of reasoning raised upon them." Now and again, therefore, we suspect in Prof. Sollas the artist who feels in him a mission to produce and paint, even if in perishable pigments. The pigments are not his fault; they are all that others will provide for him; but the artist in him must find expression, spite of all. After this, dare we revert to the passage in the preface in excuse of "the clumsiness of a geologist"?

The summary of the results of the famous Funafuti boring is very welcome, especially in view of the cautious absence of generalisations that characterised the Royal Society report. It is a matter of regret that von Richthofen should have passed away without reading the authoritative re-vindication of his views as to reefs in Tyrol contained on pp. 131 and 132 of the present volume.

The sixth chapter, on "The Origin and Formation of Flints," should set at rest many fantastic theories still prevalent among amateur geologists. We only wish that the numerous flints of radiolarian origin could have been included in this lucid essay. Zoologists will be especially attracted by the next chapter, on "The Origin of Freshwater Fauna" (faunas?), in which Lake Tanganyika, among other areas, is discussed. William Smith's views on the contemporaneity of similar faunas are defended in "The Key to Terrestrial History"; and an address on "Geologies and Deluges," in which objection is properly taken to Suess's reliance on the Chaldean narrative of the deluge, concludes the varied and uniformly interesting series.

If we accept "planctone"—but would the author write "gnomone"?—the only slips that we notice in this excellent book are in proper names, Burnett,